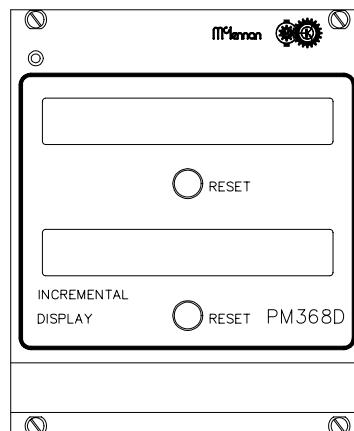
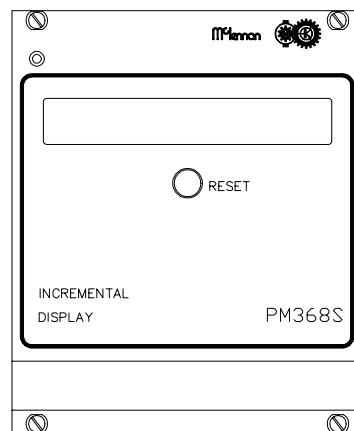
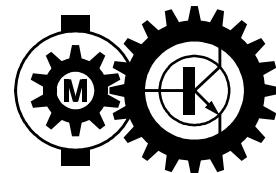


McLennan Servo Supplies Ltd.

McLennan



User Manual For

PM368

Incremental Encoder Display

USER'S MANUAL FOR PM368

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PM368 HANDBOOK REV 1.0

The manufacturer reserves the right to update the data used in this manual, in line with product development, without prior notice.

THIS MANUAL COVERS ROM VERSION 1.0

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DESCRIPTION

The PM368 is an RS232 interfaced Eurocard-format intelligent incremental encoder display. It is available in two forms:

- The PM368S single axis display.
- The PM368D dual axis display.

The PM368 will continuously monitor the position of an encoder and display the position on a front panel mounted, seven-digit display. This position may be scaled into working units. It is also possible to display the current velocity of the encoder.

The display is designed to act as a standard 1 to 1 display in its default condition but may be configured for functions that are more useful. All set up parameters are sent using commands in ASCII format, sent down the RS232 data path in a similar format to PM300 series controllers. These parameters are stored in the on-board battery backed RAM and persist after power down.

Commands may be sent from, and replies received by a terminal or computer. A number of the displays or controllers may be daisy chained on a single RS232 port, since each command is prefixed with a number defining the axis to be addressed. It will simply "pass on" a command preceded by a number other than its own.

Each axis display has a 'RESET' button below it. This button must be pressed for at least one second. It will only function if it is enabled by both hardware and software. The reset position may be set to a position other than its default of zero.

If the number to be displayed exceeds the scope of the seven digits of the display, then it will display *HHHHHHHH* for a number too big or *LLLLLLL* for a number too negative.

The displays may also be put into '*RETENTION MODE*' (or remember mode) so that the positions are retained after power down. These positions will flash to show that they may not be accurate (if the axis has moved whilst the power was off). They may be accepted as valid positions by a reset, either by the front panel pushbutton or by external reset. After this has been done, the flashing will cease. Subsequent resets will perform their usual function.

ENCODERS

The encoder should be of the quadrature type. All of the transitions on both tracks of the encoder are counted, giving an overall count of four times the number of pulses per revolution of each track, see below:

Nominal count (pulses / rev)	1	2	3	4												
Channel A	+-----+	+-----+	+-----+	+-----+												
	--+	--+	--+	--+												
Channel B																
	+-----+	+-----+	+-----+	+-----+												
	--+	--+	--+	--+												
4 x resolution	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

The unit has inputs for either TTL output (or *sinking* open-collector output) or the more preferable RS422 complementary output type. An on-board switch selects between the two sets of inputs for each axis; SW2 for the first axis, SW3 for the second axis. The regulated 5 volt output may be used to power the encoder. The leads to the encoder should be screened, with the screen grounded. There are also open-collector encoder outputs for connection to controllers etc.

If the sense of direction of the encoder is wrong, it may be reversed by either swapping the A & B signals or by simply setting the scaling factor to a negative value.

Ranges of suitable encoders are available for use with the PM368 displays. Please contact the McLennan Servo Supplies sales office for more information.

OTHER INPUTS AND OUTPUTS

The PM368 has a number of inputs that are pulled-high internally to +5V. They may accept TTL signals or may be pulled low to 0V by a switch, open collector driver or an opto-isolator.

For each axis, there are the following inputs:

FPRESETEN The front panel reset button is not enabled unless this input is low.

EXTRESET The display is immediately reset to the reset position when this input is low.

There is also the following general input:

DISPBLANK All displays of the unit are blanked when this input is low.

For each axis, there is the following open-collector output:

RESETOUT This output is pulled low if the displayed number is not within the window of the reset position.

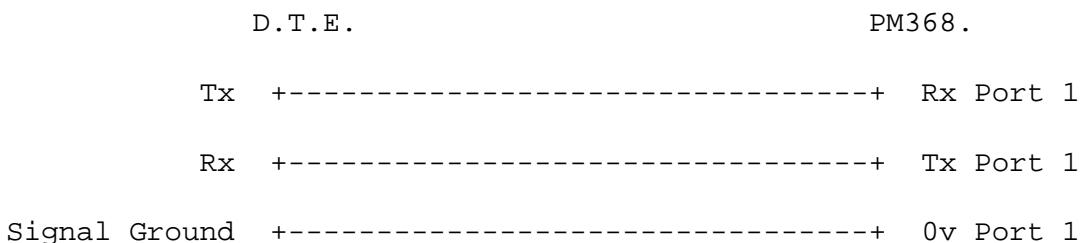
RS 232 INTERFACE CONNECTIONS

The PM368 module accepts instructions from the RS232 serial data input.

(N.B. - Transmitted characters are not echoed back to the terminal.)

The RS232 is configured in a three-wire format. No handshaking is used.
For PM368 pin number identification, please refer to connector diagram.

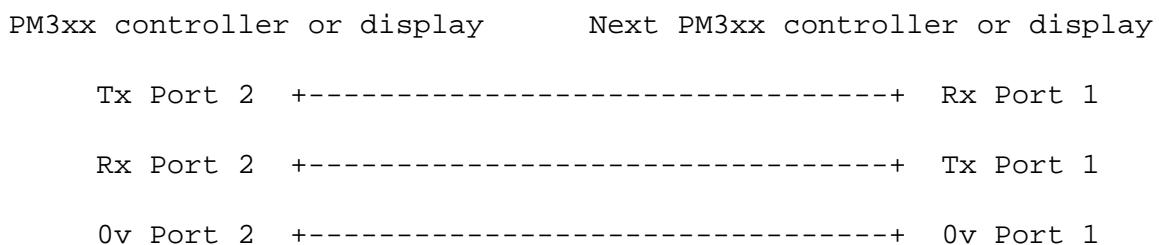
Connections to three-wire DTE (Data Terminal Equipment).



Connections for PM300 series multi-axis applications:

"Port 1" connections are as shown above, further PM300 series displays or controllers are then "daisy-chained" as shown here:

Connections with three-wire DTE.



DIL SWITCH

On the PM368 board will be found an 8 row *dual-in-line* switch this designates the axis address number of the device and protocol of the RS232 data bus.

The functions of the eight switches are defined in the tables below.

N.B. In these tables, 1=ON, 0=OFF.

SWITCH NO.	RS 232 MODE	DATA FORMAT	SWITCH NUMBER.	ADDRESS	AXIS
6	5		4 3 2 1		
0	0	7 BITS,EVEN PARITY	0 0 0 0	200	
0	1	7 BITS,ODD PARITY	0 0 0 1	201	
1	0	7 BITS,ZERO PARITY	0 0 1 0	202	
1	1	8 BITS,NO PARITY	0 0 1 1	203	
			0 1 0 0	204	
SWITCH NO.	RS 232 MODE	BAUD RATE	0 1 0 1	205	
8	7		0 1 1 0	206	
0	0	9600	0 1 1 1	207	
0	1	4800	1 0 0 0	208	
1	0	1200	1 0 0 1	209	
1	1	300	1 0 1 0	210	
			1 0 1 1	211	
			1 1 0 0	212	
			1 1 0 1	213	
			1 1 1 0	214	
			1 1 1 1	215	

Example: When the switch is set as shown here,

Switch No:	8	7	6	5	4	3	2	1
State:	0	0	1	1	0	0	1	1

the PM368 would respond to commands prefixed by the number 203, and can be addressed at a baud rate of 9600. The data format would be 8 data bits, NO parity and 1 stop bit.

NOTE: The second axis of the PM368D display is addressed as one more than the number of the first axis. I.E. the above number +1.

COMMAND WORD SYNTAX

Most commands are two letters, the function of each, being described below. Each command is preceded by the appropriate address to identify the axis for which the command is intended.

Where applicable (e.g. setting of system parameters, etc.) the command should then be followed by the desired value:

aXXnnn

a = address

XX = command

nnn = value (if required)

Command strings should be terminated with a carriage return character (ASCII 0C hex).

Upper or lower case characters may be used for the command. Spaces within the command line are ignored.

Replies

Responses to commands are prefixed by the axis address number followed by ":", and then either "OK" or an alpha-numeric string (depending on the command being responded to) once the command has been accepted. Each line terminates in carriage return (0C) and line feed (0A). Each response is terminated with a null character (00). If an error situation is created, an error message appropriate to a mistake or conflicting instruction is sent. Error messages have a "!" after the ":". See Error Messages p10.

All commands with the exception of **Control C** and **ESC** are buffered so that a *write-ahead* approach to programming may be used. Commands are executed in consecutive order.

ALL SET-UP PARAMETERS RELATING TO THE BEHAVIOUR OF THE DISPLAY WILL BE HELD IN THE BATTERY-BACKED RAM ON POWER-DOWN. THEY WILL REMAIN AT THE PREVIOUSLY SET VALUES UNTIL ALTERED VIA THE RS 232 BUS.

PROGRAMMING THE UNIT

N.B. Commands are buffered and will only be executed after completion of the previous command.

GENERAL COMMANDS

ID IDENTIFY

The command ID returns the software version. The string is of the form "PM368S single axis VER 1.0" or "PM368D dual axis VER 1.0".

HE HELP

Displays a memory jogging list of commands available and their function.

DV DEFAULT VALUES

Set all constants to default values. I.E. 1:1 scaling, position display etc.

SCALING FACTORS

The incoming encoder pulses are multiplied by the numerator and divided by the denominator to give a scaled number. These may be set to give a display in working units (e.g. millimetres, degrees etc.).

EN ENCODER NUMERATOR Range: $\pm 1\text{-}32767$ Default: 1
Set the numerator for the scaling factor to the value specified.

ED ENCODER DENOMINATOR Range: $\pm 1\text{-}32767$ Default: 1
Set the denominator for the scaling factor to the value specified.

DISPLAY FUNCTIONS

PD POSITION DISPLAY

Set display mode to display the scaled position of the encoder.

VD VELOCITY DISPLAY

Set display mode to display the scaled velocity of the encoder.

DD DIFFERENCE DISPLAY

Dual Axis Version Only

Set display mode to display the difference between the scaled positions of this axis and the other axis of this module.

BD BLANK DISPLAY

Set display mode to blank display. All data is still accessible via RS232 interrogation.

DP DECIMAL POINT POSITION Range: 0 - 7 Default: 0
 Select decimal point position.

± . 8 . 8 . 8 . 8 . 8 . 8 . 8
 7 6 5 4 3 2 1

Position zero (default) displays no decimal points.

NOTE: This is purely a displaying function and does not affect the displayed number. Please adjust scaling factors to give required number.

LZ LEADING ZERO SUPPRESSION Range: 0 or 1 Default: 0
 Set leading zero suppression mode.

LZ0 Leading zero suppression ON. E.G. 37.84
LZ1 Leading zero suppression OFF. E.G. 00037.84

GT GATE TIME Range: 5 - 10000 Default: 5
 multiples of 5 only!

Set the gate time between updating the display in milliseconds. This value is also used for the averaging time for the velocity display and may be set higher to give a more accurate, but less frequently updated display.

RM RETENTION MODE Range: 0 or 1 Default: 0
 Set retention (remember) mode.

RM1 Retention mode ON.
RM0 Retention mode OFF.

QUERYING VALUES AND SETTINGS

OE OUTPUT ENCODER POSITION

Interrogate and return the current unscaled encoder position. This would normally only be used when setting up a system.

OA OUTPUT ACTUAL POSITION

Interrogate and return the current scaled encoder position. Decimal points are not given.

OV OUTPUT VELOCITY

Interrogate and return the current velocity of the encoder. This is averaged over the gate time set for this axis.

QA QUERY ALL

Interrogate and return all current set-up parameters etc. in the following format:

201:

Encoder Position	= 0
Scal ed Posi ti on	= 0
Encoder Numerator	= 1
Encoder Denomi nator	= 1
Reset Posi ti on	= 0
Wi ndow	= 0
Gate Ti me	= 5
Front Panel Reset	= Enabl ed
Di spl ay Mode	= Posi ti on
Retenti on Mode	= On

NOTE that the 'Front Panel Reset' only shows if it is software enabled and does not take account if the external hardware enable is active.

SET AND RESET POSITION FUNCTIONS

AP	ACTUAL POSITION	Range: ± 0 - 2147483647	
Set the current actual (scaled) position to the value given. This does not affect the raw encoder position.			
SR	SET RESET POSITION	Range: ± 0 - 2147483647	Default: 0
Set the reset position to the value given. When a future reset occurs, by either from the front panel reset button, external reset input or by a power-up reset, the position will be set to this value.			
WI	WINDOW	Range: ± 0 - 2147483647	Default: 0
Set the window for the 'RESETOUT' output. This output will be pulled low if the displayed number is more than this window away from the Reset Position. Because this acts on the displayed number, it will work for a velocity or difference display. This output will therefore only be updated as often as the gate time for that axis.			
ER	ENABLE FRONT PANEL RESET		Default: Enabled
Enable the front panel reset button by software. The external 'FPRESETEN' input signal must also be enabled for the button to function.			
IR	INHIBIT FRONT PANEL RESET		Default: Enabled
Disable the front panel reset button by software.			

ERROR MESSAGES

In the normal course of programming the PM368, the device responds to a standard command input by replying with an "OK" answer to the programmer once the command has been accepted, (see previous page for string format).

Alternatively, if the command is to query a value or constant, the PM368 simply gives the numeric answer. However, the user may encounter "error messages" appropriate to a mistake or conflicting instruction, the meaning of which is usually self-explanatory, but are explained below:

200: ! ILLEGAL COMMAND !

Command not recognised by the PM368. Self-explanatory but often seen when miss-keyed commands are sent!

200: ! OUT OF RANGE !

Command numeric value is higher or lower than allowed. (See "command syntax" section.)

200: ! ZERO NOT VALID !

The numeric value of zero (or if omitted) is not valid.

200: ! MUST BE DIVISIBLE BY 5 !

The numeric value attempted was not a multiple of 5.

SUMMARY TABLE OF COMMANDS

		PAGE
GENERAL COMMANDS		
ID	Identify the type and software version	6
HE	return HElp page	6
DV	set parameters to Default Values	6
SCALING FACTORS		
EN<value>	set Encoder Numerator	6
ED(<value>)	set Encoder Denominator	6
DISPLAY FUNCTIONS		
PD	set to Positional Display mode	6
VD	set to Velocity Display mode	6
DD	set to Difference Display mode	6
BD	set to Blank Display mode	6
DP<0-7>	set Decimal Point position	7
LZ<0/1>	set Leading-Zero suppression mode	7
GT<5-10000>	set Gate Time in milliseconds	7
RM<0/1>	set Retention Mode	7
QUERYING VALUES AND SETTINGS		
OE	Output raw unscaled Encoder position	8
OA	Output scaled Actual position	8
OV	Output Velocity	8
QA	Query All values	8
SET AND RESET POSITION FUNCTIONS		
AP<position>	set Actual Position to a value	9
SR<position>	Set Reset position to a value	9
WI<value>	set WIndow	9
ER	Enable front panel Reset	9
IR	Inhibit front panel Reset	9

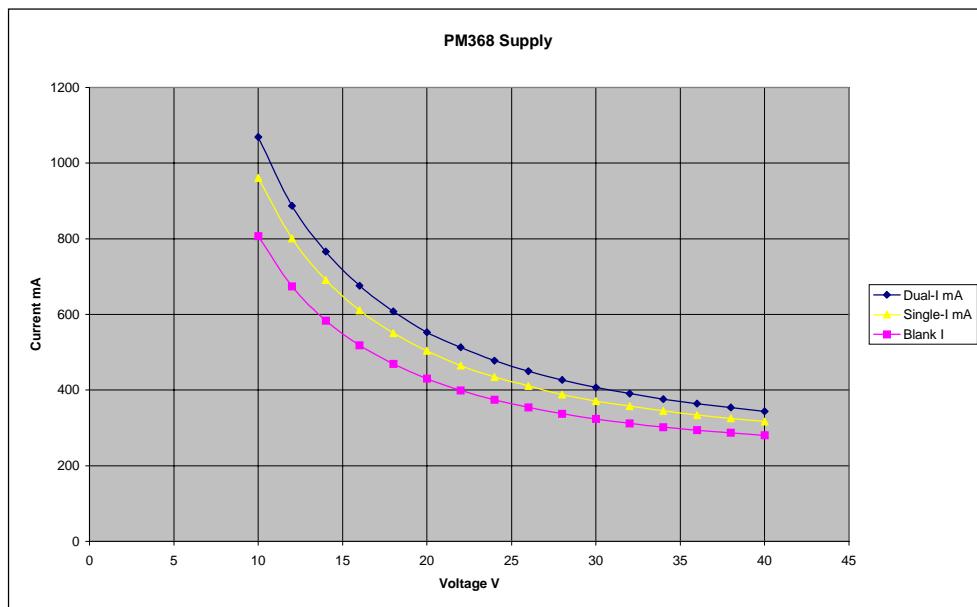
PM368 REAR CONNECTOR PIN ASSIGNMENTS AND FUNCTIONS**CONNECTOR - DIN 41612, 64 WAY ROWS A & B**

Rear view

	b	a	
LOGIC SUPPLY (24v nominal 10v min - 40v max.)	+-----+	*---1-*	
AUX 5V OUTPUT (600mA Max)		*--2-*	
		* 3 *	
		* 4 *	
		--5-	
		* 6 *	
		* 7 *	
		* 8 *	
		* 9 *	
		* 10 *	
		* 11 *	
Second encoder RS422 A+ i/p	* 12 *	First encoder RS422 A+ i/p	
Second encoder RS422 A- i/p	* 13 *	First encoder RS422 A- i/p	
Second encoder RS422 B+ i/p	* 14 *	First encoder RS422 B+ i/p	
Second encoder RS422 B- i/p	* 15 *	First encoder RS422 B- i/p	
Second encoder TTL A i/p	* 16 *	First encoder TTL A i/p	
Second encoder TTL B i/p	* 17 *	First encoder TTL B i/p	
	* 18 *		
Second encoder A Output	* 19 *	First encoder A Output	
Second encoder B Output	* 20 *	First encoder B Output	
	* 21 *		
Second axis RESETOUT o/p	* 22 *	First Axis RESETOUT output	
	* 23 *		
Second axis FPRESETEN i/p	* 24 *	First axis FPRESETEN input	
Second axis EXTRESET i/p	* 25 *	First axis EXTRESET input	
	* 26 *	Both axes DISPBLANK input	
RS232 Port2 Tx Transmit o/p	* 27 *	RS232 Port 1 Tx Transmit o/p	
RS232 Port2 Rx Receive i/p	* 28 *	RS232 Port 1 Rx Receive i/p	
	+--*-29-*		
	+--*-30-*		
	+--*-31-*		
0V Common	--+-*32-*		
	+-----+		

Input and output specifications:

Supply Current with 600mA taken from +5V output



All signal inputs except RS232 and RS422 are TTL:

High state threshold is 1.5v

Low state threshold is 0.6v

Encoder TTL inputs are pulled up to 5v via $1K\Omega$

All other inputs are pulled up to 5v via $3K3\Omega$

All signal outputs except RS232 are open collectors:

Max high level output voltage 30V

Max low level output current 30mA

A MSB143 motherboard may be used to facilitate connection.

MSB143 Motherboard

The MSB 143 is a convenient way of making external connections to the PM368 Display module. The unit is designed for fitting to the rear bars of a 19 in. Euro-rack and incorporates the mating connector for the PM368 display. The MSB 143 enables all connections to be made via plug-in screw terminal blocks with the exception of the RS232 connections which are made via 3 way MOLEX type plugs. This motherboard has been designed for use with both the PM368 incremental encoder displays and the PM367 absolute encoder display. For this reason, some of the terminals are marked with two legends, the same terminal being used for different functions on the two types of display. Only the relevant legends are shown below.

Terminals are provided for:

INC1A+	Complimentary (RS422) encoder inputs.
INC1A-	
INC1B+	
INC1B-	

TTL1A	TTL encoder inputs.
TTL1B	

+5V	Encoder supply output (+5V).
0V	

IOUT1A	Open collector quadrature outputs.
IOUT1B	
0V	

RESOUT1	Open collector output for when within its window of its reset position (RESETOUT).
0V	

FPRESEN1	Front panel reset-enable input.
EXTRESET1	External reset input.
0V	

The above connections are for the first axis. There is also an equivalent set of terminals for the second axis of a PM368D.

DISPBLNK	Display blanking input.
0V	

+VLL	Power supply inputs.
0VLL	

RS232 PORT1	RS232 serial comms to host computer/terminal.
TX	Transmit output.
RX	Receive input.
0V	

RS232 PORT2	RS232 comms to other units (daisy-chain).
TX	Transmit output.
RX	Receive input.
0V	

Basic connections for MSB143 using PM368S single axis display: